04 RESILIENCE

U.S. Department of Energy Solar Decathlon 2020

TEAM Net Zero

WEBER STATE UNIVERSITY

04. RESILIENCE

Students from Weber State University Department of Construction & Building Sciences made up the senior project team representing departments:

- Building Design & Construction
- Interior Design
- Construction Management

Our team constructed the all-electric home they designed, in collaboration with Ogden City, on the corner of 28th street and Quincy Avenue.

The 2,540 total square foot home (1270 on main and 1270 full finished basement) incorporates portable battery backup technology to allow the home to maintain critical loads for up to 72 hours if the electrical grid were to be down in a natural disaster or emergency. Not only will the Solar Array generate enough energy to offset the energy usage of the home annually, it will also generate enough electricity to charge an electric vehicle to travel 20 miles per day.

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The lot was donated by Ogden City to show their commitment to revitalizing neighborhoods and breathing new life into historic districts.

This particular lot sat empty for nearly 10 years after a dilapidated 4-plex was torn down. The Craftsman Architectural Style home was intentionally designed to nestle in nicely with other homes on this historical avenue and showcase how a period style home can provide a net-zero energy lifestyle.

Students worked with city planners to design a home that would fit on the narrow deep lot. The home was 24' wide x 58' deep with a detached garage. Students were provided a set of plans that the city planners had designed that they were open to allowing us to alter to be part of the Solar Decathlon competition.

The design was dictated by the setback of the lot. It was a very difficult lot to build on because of it being a corner lot and having 20' setbacks from the back side of the existing sidewalks. A 6' setback on the west side required that windows be strategically placed so they didn't look directly into windows of the neighbors.

We discovered that the "free" lot that was donated by the city had a long list of issues. The debris from the old four plex had been buried on site and we spent an additional $20,000 hauling it away along with some dead trees and substantial root networks that required removal. An underground aquafer that ran through the site just a few inches below our footings which necessitated the installation of a perimeter and partial French drain that cost an additional $2,500.

We were required to replace all of the exiting sidewalk, curb, gutter, and existing driveway approaches left over from the four plex which cost an additional $25,000. The sewer lateral was only 4' below grade even though we were told it was deep enough to allow a gravity fed plumbing connection and therefore had to install an ejector pump to the cost of nearly $3,500. We were required to install new sewer and water laterals across the adjacent street which cost nearly $18,000.

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From the street, other than the solar panels, there is no distinct differentiation that this home is a net positive all electric home capable of producing all of its own energy annually, maintaining all of its critical loads in excess of a week, as well as charging an electric car to drive up to 20 miles per day in the detached garage. This was on purpose! We wanted to prove that you can build a net zero home without it sticking out so it would appeal to a larger audience.

We designed large overhangs to nearly eliminate solar heat gain in the summer due to shade angles. We maximized the windows on the East side to allow solar heat gain in the winter, but limited the west facing windows and eliminated all windows on the south to minimize solar heat gain during the summer.

The view of the picturesque Rocky Mountains are to the East. All of the living space was intentionally placed on the East side of the home in conjunction with large windows to allow ample daylight and stunning sunrises and sunsets.

The home is long and narrow, therefore long site lines were designed to allow the feeling of a more open floor plan. All upstairs hallways were eliminated to open up the spacious feel of the floor plan and to accommodate for ADA accessibility.

All potential buyers who walked through the home commented on how much bigger it felt than it appeared from the exterior. We knew we were successful when the sub-contractors who were working on the build started asking if they could buy the home.

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The color selection was reversed on the inside of the home to allow off white walls to be painted with a semi-gloss paint while applying color to the trim and doors. This allowed the natural light coming in from the large east facing windows to reflect off the paint sheen and flood the main floor.

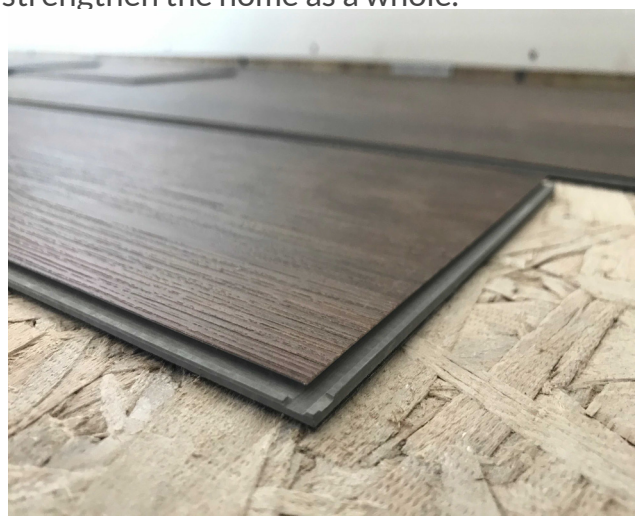
The oversized basement windows allowed the same so there is no need to have artificial light during the day. These large windows help connect the occupant with the outdoors while also allowing for cross ventilation in the spring and fall to passively heat and cool the home.

We specified dark laminate vinyl planks throughout the main level to absorb solar heat gain and maximize the thermal mass advantages.

All efforts were made to use recycled materials, no VOC's, long life and energy efficient products. Cradle to cradle LVP was installed upstairs, along with budget friendly wool carpet.

The home is 100% LED fixtures with only the bathroom vanity lights requiring light bulbs.

We intentionally did not specify any materials that were not readily available in our local market. All products were sourced from big box stores, distributors or local hardware stores. Each material and appliance is very resilient and helped strengthen the home as a whole.



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Resilience is embodied through out the home in so many different ways. Everything from the solar panels, the ICF's, the SIPs, and all the other small components that come together to make the home. As we built the home, we kept in mind the east winds that frequent Northern Utah. Our home has experienced two 100 year wind storms and no damage was done except for one of the trees that was planted was blown over. Hardi cement board exterior, aluminum soffit and fascia, 30 year asphalt shingles with 7:12 pitch allowed us to weather these storms.

UTAH

‘It looks like a war zone’: Destructive winds wreak havoc in northern Utah

Power in some areas could be out for days as Utahns prepare to clean up; 1 ‘weather-related fatality’ reported

By Pat Reavy and Daedan Olander | Updated Sep 8, 2020, 7:08pm MDT

Each element on the exterior was chosen to help withstand the large gusts of wind that topple trees, knock down power poles, and rip vinyl siding to shreds.

We chose a solid insulated concrete form foundation (ICF) insulated on the inside and out to create a very well insulated basement. The main floor walls were constructed out of structural insulated panels (SIPs) to insure less rattling and less noise from the wind entering through small gaps. We went with a Hardi siding made of cement fiber to allow minimal damage during wind storms.

With power outages lasting up to a few days, our battery back up system has proven to allow for occupants to have electricity and heat. Allowing occupants to be comfortable through the wind storm. The backup system provided by energy retained through the solar panels makes this feat possible.